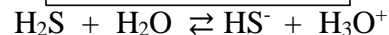


Buffer calculations

Calculate the pH of a buffer solution where $[\text{H}_2\text{S}] = 0.0515 \text{ mol L}^{-1}$, $[\text{HS}^-] = 0.105 \text{ mol L}^{-1}$, $\text{pK}_a(\text{H}_2\text{S}) = 6.98$

Using K_a

$$K_a = \frac{[\text{A}^-][\text{H}_3\text{O}^+]}{[\text{HA}]}$$



$$\text{pK}_a = -\log K_a$$

$$6.98 = -\log K_a$$

$$\text{inverse log } -6.98 = K_a$$

$$1.047 \times 10^{-7} = K_a$$

$$K_a = \frac{[\text{HS}^-][\text{H}_3\text{O}^+]}{[\text{H}_2\text{S}]}$$

$$1.047 \times 10^{-7} = \frac{[0.105][\text{H}_3\text{O}^+]}{[0.0515]}$$

$$\frac{(1.047 \times 10^{-7})(0.0515)}{0.105} = [\text{H}_3\text{O}^+]$$

$$5.135 \times 10^{-8} = [\text{H}_3\text{O}^+]$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+]$$

$$\text{pH} = -\log 5.135 \times 10^{-8}$$

$$\text{pH} = 7.289$$

Answer: 7.29

Round up at the very end only!

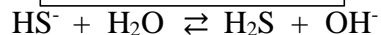
Answer to 3 sig figs

UNITS where relevant

OR

Using K_b

$$K_b = \frac{[\text{BH}^+][\text{OH}^-]}{[\text{HB}]}$$



$$\text{pK}_a = -\log K_a$$

$$6.98 = -\log K_a$$

$$\text{inverse/shift log } -6.98 = K_a$$

$$1.047 \times 10^{-7} = K_a$$

$$K_b = \frac{K_w}{K_a}$$

$$K_b = \frac{1 \times 10^{-14}}{1.047 \times 10^{-7}}$$

$$K_b = 9.551 \times 10^{-8}$$

$$K_b = \frac{[\text{H}_2\text{S}][\text{OH}^-]}{[\text{HS}^-]}$$

$$9.551 \times 10^{-8} = \frac{(0.0515)[\text{OH}^-]}{0.105}$$

$$1.947 \times 10^{-21} = [\text{OH}^-]$$

$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$$

$$1 \times 10^{-14} = [\text{H}_3\text{O}^+](1.947 \times 10^{-7})$$

$$5.135 \times 10^{-8} = [\text{H}_3\text{O}^+]$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+]$$

$$\text{pH} = -\log 5.135 \times 10^{-8}$$

$$\text{pH} = 7.289$$

Answer: 7.29

Round up at the very end only!

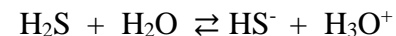
Answer to 3 sig figs

UNITS where relevant

OR

Using Henderson-Hasselbalch equation

$$\text{pH} = \text{pK}_a + \log \frac{[\text{conjugate base}]}{[\text{acid}]}$$



$$\text{pH} = 6.98 + \log \frac{0.105}{0.0515}$$

$$\text{pH} = 6.98 + \log 2.038$$

$$\text{pH} = 6.98 + 0.3093$$

$$\text{pH} = 7.289$$

Answer: 7.29

Round up at the very end only!

Answer to 3 sig figs

UNITS where relevant

Which method above would you choose?